

TCE Vapor Intrusion Investigation in a 23-Acre Building: Serving Many Stakeholders while Maintaining Mission-Critical Operations

Presented by

Karen Campbell

Naval Facilities Engineering Command (NAVFAC) SE and

Todd Creamer

Geosyntec Consultants

Objectives

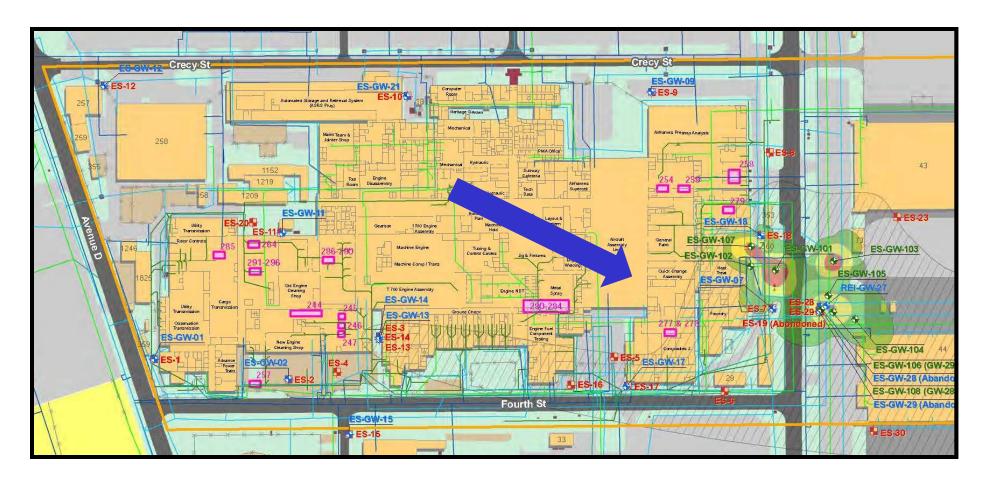


When trichloroethene (TCE) is thought to be present below a 1,000,000 sf building, we want to describe:

- 1. how to conduct a vapor intrusion (VI) investigation in such a big space in a reasonable time
- 2. how to serve mission-critical ops, sensitive receptors, occupational health requirements, 2 chains-of-command and a curious labor force during the investigation

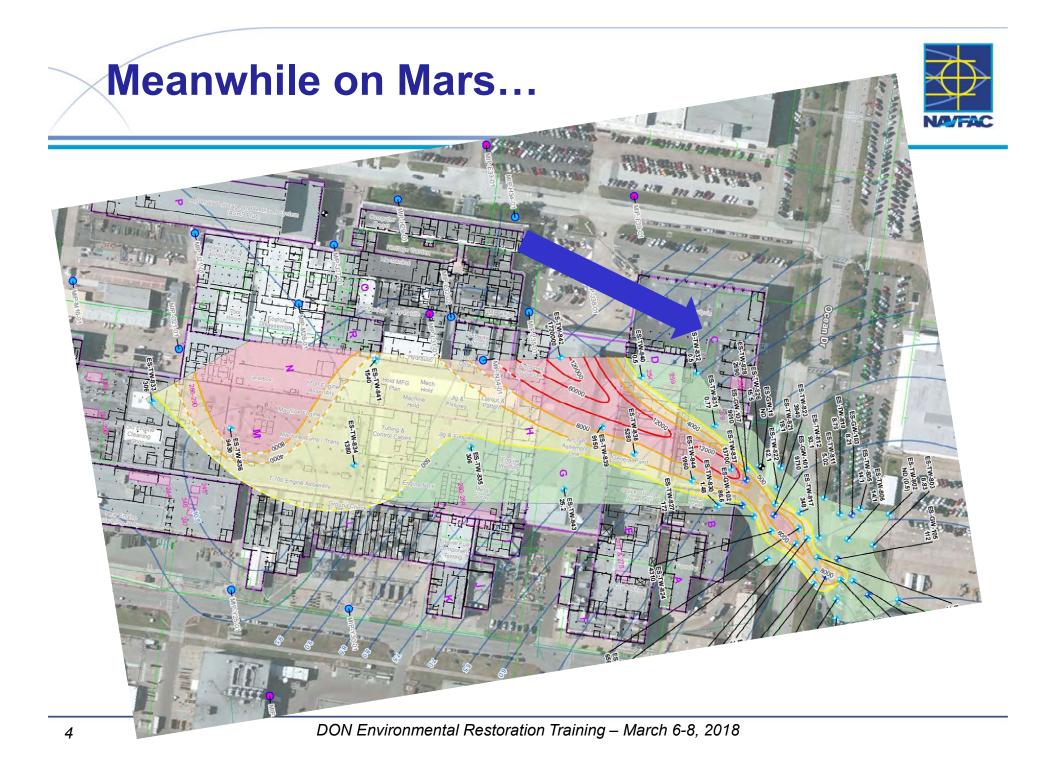
Corpus Christi Army Depot (CCAD) Building 8







Direction of GW flow



The Strategy



Question	Approach
Are there VOC sources below slab? Where?	High Volume SamplingBuild and revise CSM
If we find a source, is VI pathway complete?	Use CSMSubslab soil gas & indoor airInspect walls & floors, HVAC
Army to Navy: Will you be in my way?	Navy to Navy contractors: Don't!

High Volume Sampling (HVS) a Platform to Develop & Test Conceptual Models





Fan or Vacuum

Bleed Valve

Anemometer port

Sample Port

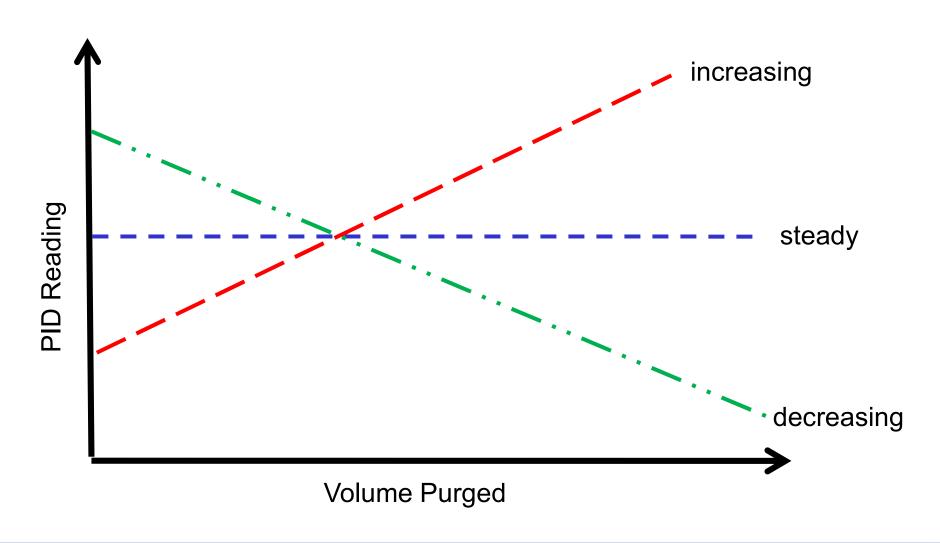
Vacuum Gauge

Extraction Point

Lung Box

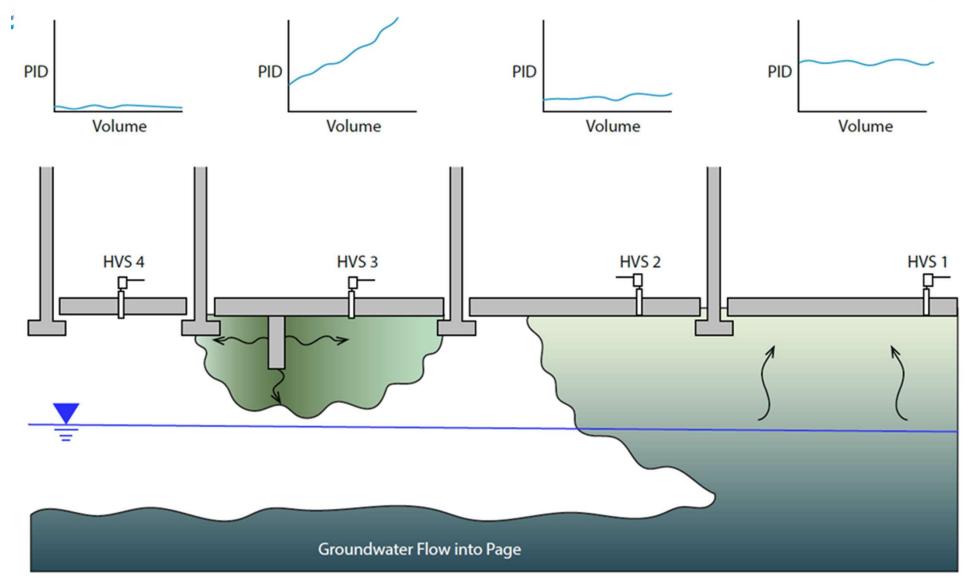
PID Reading vs. Volume Purged





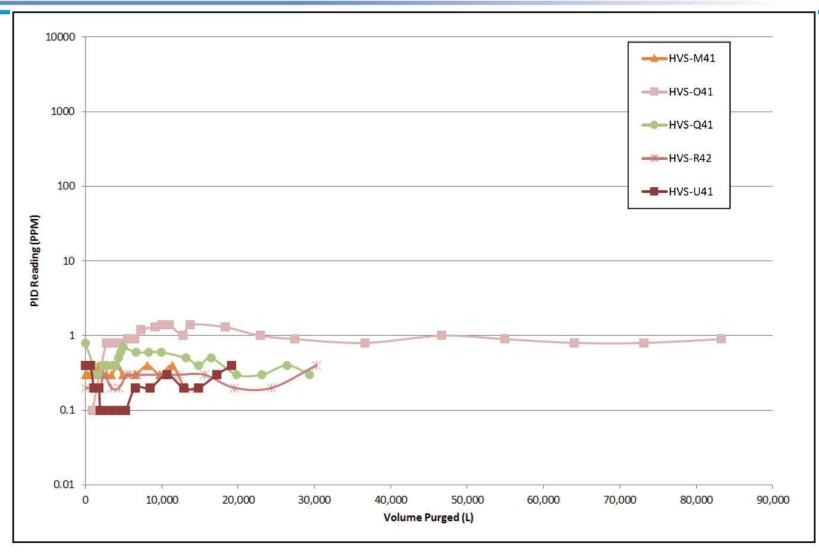
Generalized CSMs for HVS





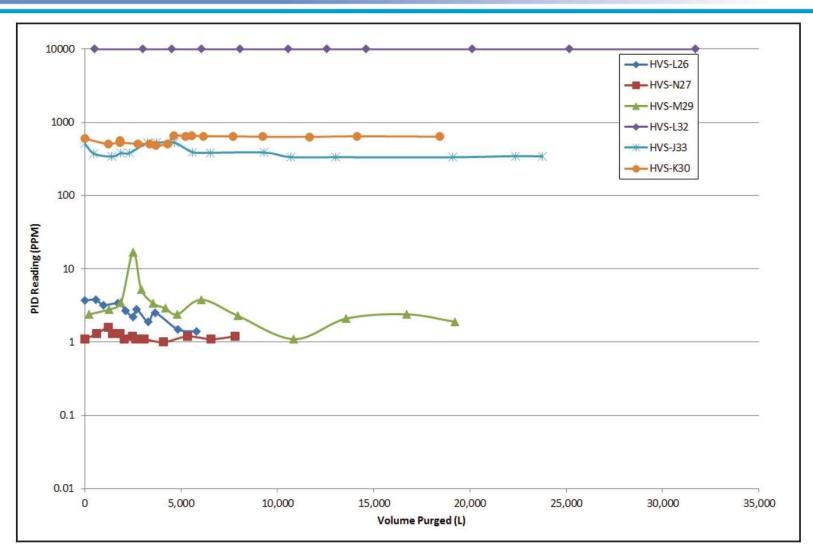
HVS Field Data Pt 1





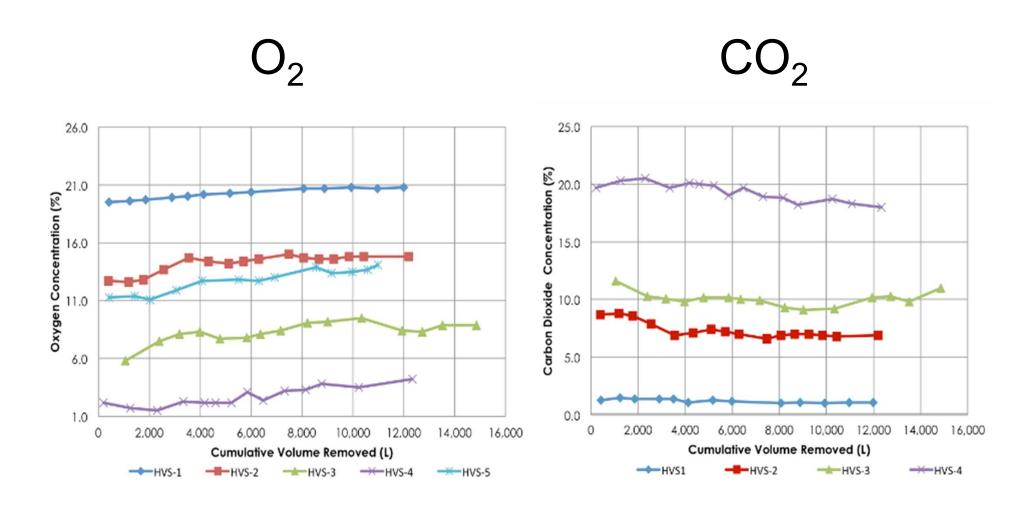
HVS Field Data Pt 2

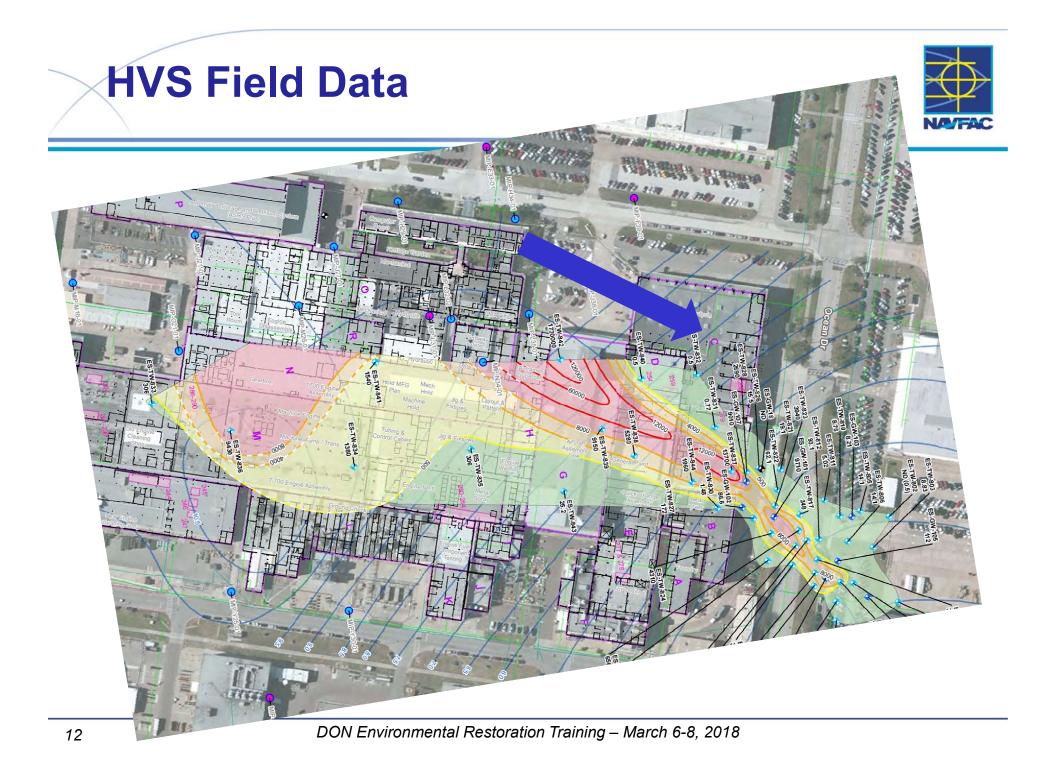


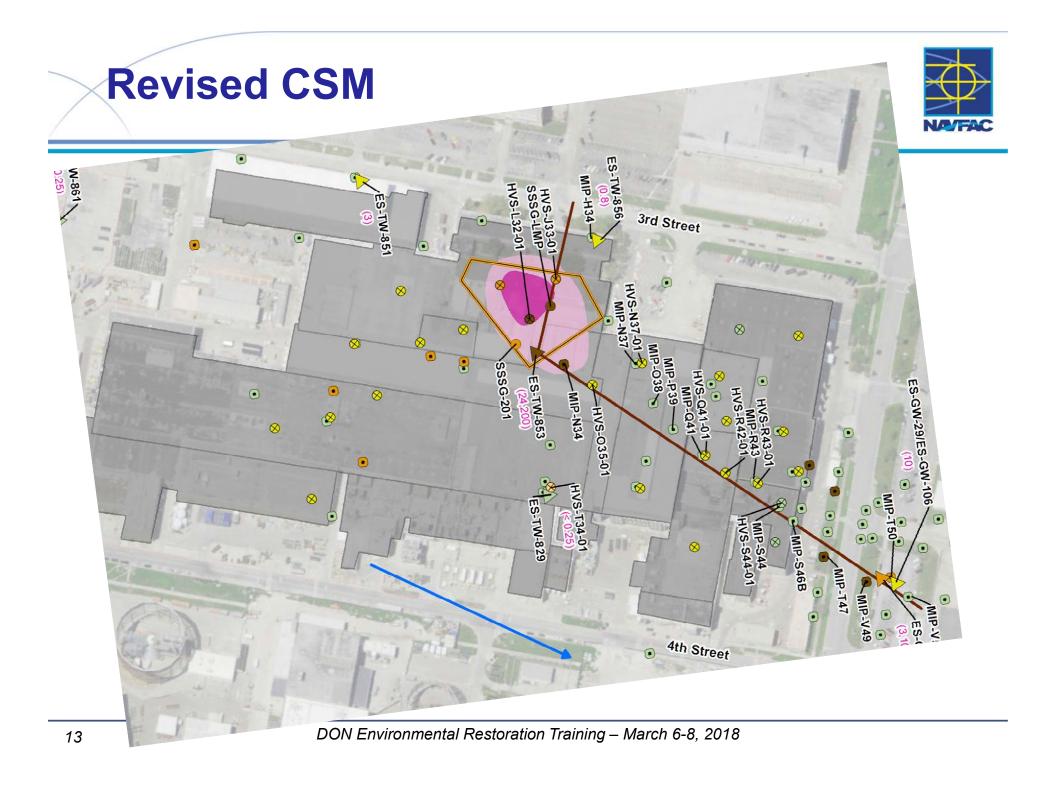


Sub-Slab O₂ and CO₂ vs. volume purged



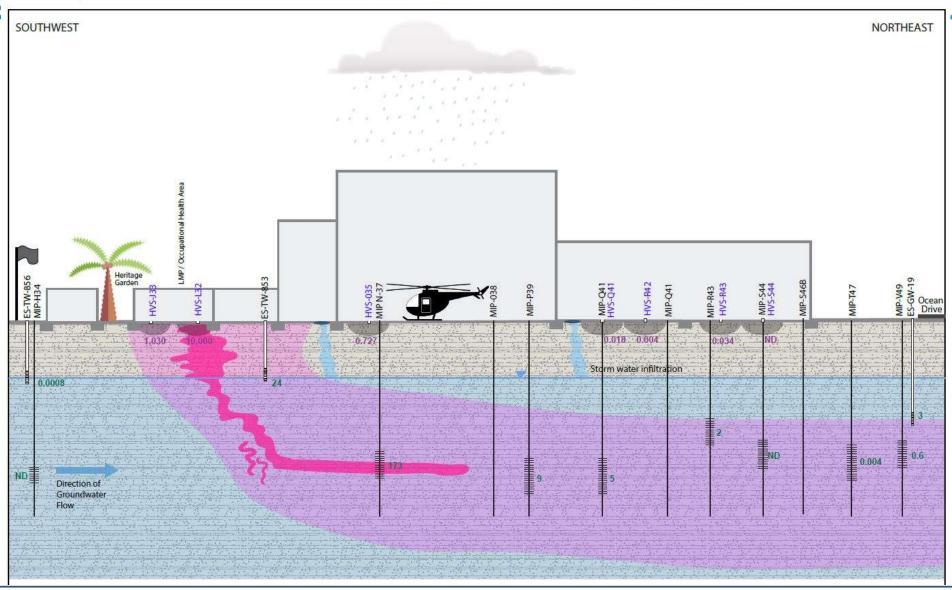






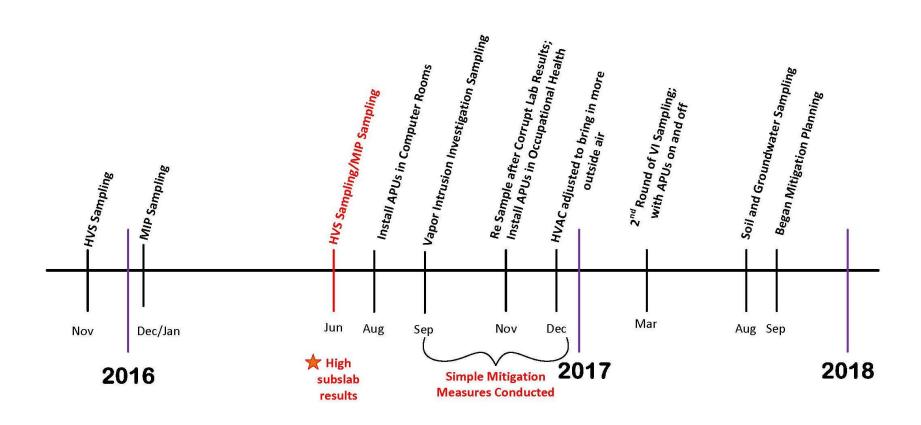
Revised CSM





Investigation Timeline





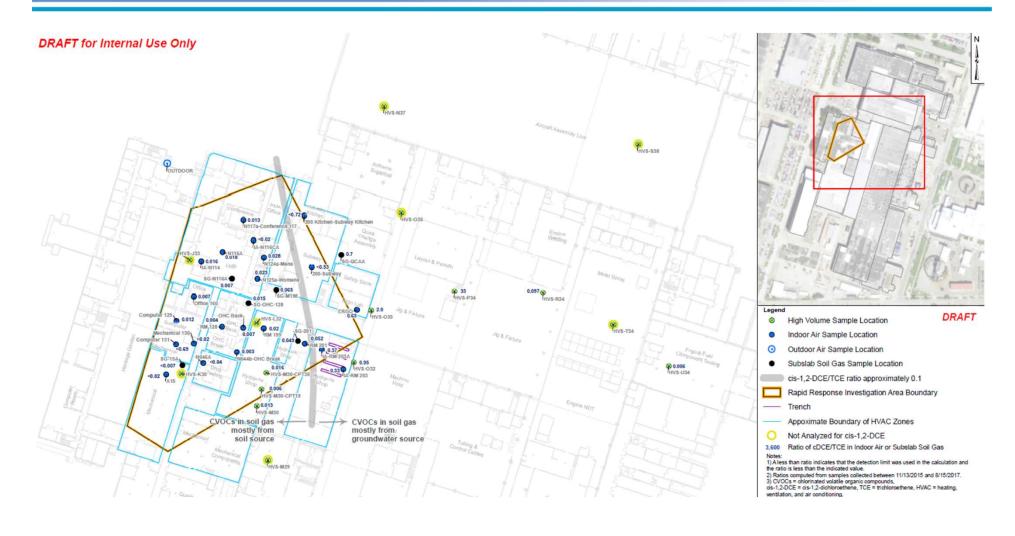
Focused Investigation in 40,000 sf: Indoor air and subslab





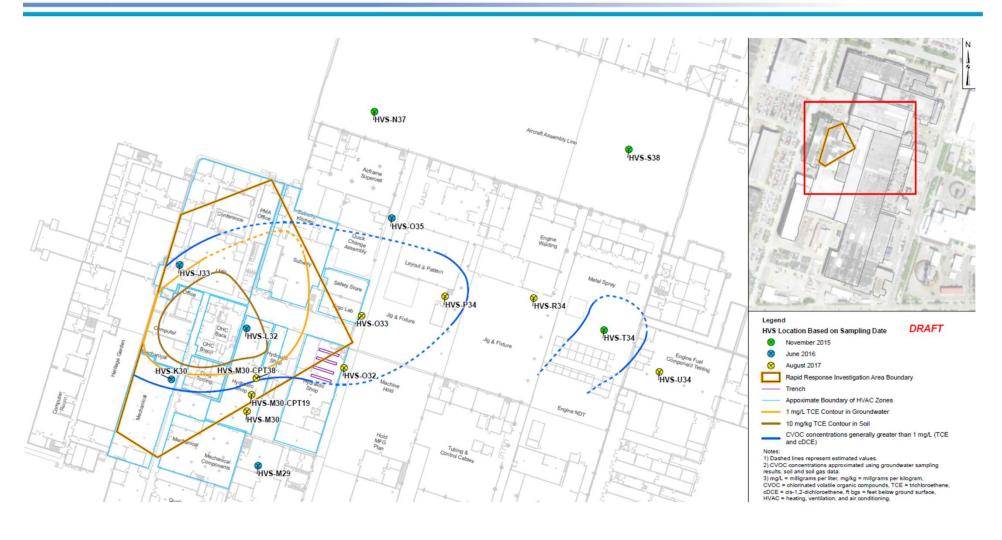
cis-1,2-DCE / TCE ratios: Using lab results to refine the CSM





Layer in Soil and GW data refine CSM





TCE Used in Building 8





MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name: LORD ACCELERATOR 4

Product Use/Class: ACRYLIC ADHESIVE, PART 2 OF 2

LORD Corporation 111 LORD Drive Cary, NC 27511-7923

Telephone: 814 868-0924

Non-Transportation Emergency: 814 763-2345 Chemtrec 24 Hr Transportation Emergency No. 800 424-9300 (Outside Continental U.S. 703 527-3887)

EFFECTIVE DATE: 04/22/2013



2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Chemical Name</u>	CAS Number	Weight % Less Than	ACGIH TLV- TWA	ACGIH TLV- STEL	OSHA PEL- TWA	OSHA PEL- CEILING	<u>Skin</u>
Methylene chloride	75-09-2	70.0 %	50 ppm	N.E.	25 ppm	N.E.	N.A.
Trichloroethylene	79-01-6	15.0%	50 ppm	100 ppm	100 ppm	100 ppm	N.A.
Methyl isobutyl ketone	108-10-1	10.0%	50 ppm	75 ppm	410 mg/m3 100 ppm	N.E.	N.A.
Benzoyl peroxide	94-36-0	10.0 %	5 mg/m3	N.E.	5 mg/m3	N.E.	N.A.
Methyl methacrylate	80-62-6	5.0 %	50 ppm	100 ppm	410 mg/m3 100 ppm	N.E.	N.A.

N.A. - Not Applicable, N.E. - Not Established, S - Skin Designation



Indoor Air Results



Summary of TCE Screening Levels µg/m³ Occupational Screening EPA Screening Level Level						CCAD Indoor
_						Air Result
OSHA PEL	ACGIH TLV TWA	Non-Cancer* HQ=1	Non-Cancer HQ=3	Non-Cancer HQ=10	Cancer 10 ⁻⁴ Risk	Maximum Concentration
537,000	269,000	8.8	26	88	300	890
*Note: TCE toxicity driving non-cancer screening levels is based on a controversial study suggesting potential for fetal heart malformations. Dispute continues among toxicologists.						

Coordination with CCAD



- Access:
 - CCAD escorts needed for contractors & Navy
 - Worked with CCAD Environmental Department to coordinate escort availability and access
- Schedule: (2nd shift & weekends)
 - Shut down Automated Guided Vehicles (AGVs)
 - Reduce unneeded interaction with CCAD employees



Coordination with CCAD



- Screening & Decision Levels?
 - Army Occupational Health responsible for their employees
 - When to mitigate?
- Risk Communication:
 - Army OHC handled all
 - Union grievances filed against sampling crews – reflect on what you say to whom!
 - Command briefings to Navy & Army (This is TCE, remember Yorktown?)



Coordinating Results with CCAD



- Notified CCAD Industrial Hygienist and Environmental Management
- CCAD notified union
- CCAD IH discussed results with females working in the Occupational Health Clinic
- CCAD IH conducted personal air samples for workers

Mitigation Measures



- CCAD Facilities and Maintenance
 - Sealed holes and cracks in walls
 - Sealed SUMP cover in Mechanical Room
 - Increase amount of outdoor coming in through HVAC systems, before was 0-5% increased to 30%
- Installed Air Purifying Units (APUs) in Occupational Health Clinic and Computer Rooms
 - Carbon filters replaced every three months, CCAD handles disposal

Mitigation Measures –Sump



Sump with 1,500,000 $\mu g/m3$ before and after mitigation





Knowledge Check



True or False

 trans-1,2-DCE in indoor air is an excellent indicator of complete VI pathway from GW

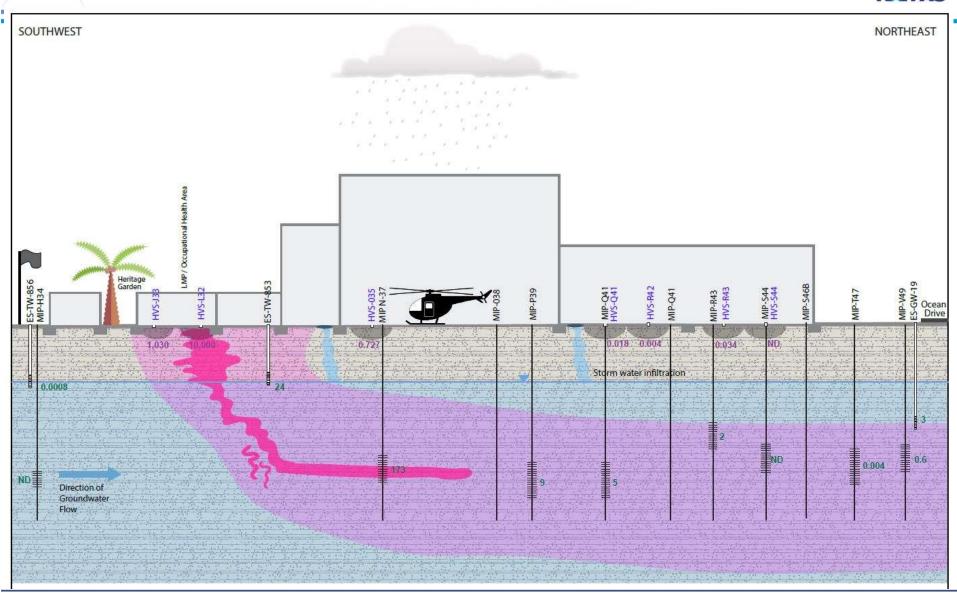
cist 2.DCE

What good are O₂ and CO₂ data in soil gas?

- Helps me know I got good samples
- I need one of those to live!
- Help to build CSM: petroleum or CVOCs?
- All of these

One Ring to Bind Them





Summary



Highlight Key Take Away Messages

- Do not "pincushion" big buildings with subslab samples this is unnecessary, invasive and expensive
- Use all the data to develop a picture of sources
- There are many interim mitigation steps you can take
- Show a timeline of actions, especially when responding to TCE in indoor air
- Background sources matter & ruling them out is a strong position

Contacts and Questions



Points of Contact

NAVFAC LANT: Donna Caldwell

donna.caldwell@navy.mil

NAVFAC SE: Karen Campbell

karen.j.campbell@navy.mil

Questions?